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EXAMINER

WARTALOWICZ, PAUL A

ART UNIT

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1793

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/777,033	Applicant(s) TONKOVICH ET AL.	
	Examiner PAUL A. WARTALOWICZ	Art Unit 1793	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 February 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 and 33-79 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 73 and 74 is/are allowed.
- 6) ☒ Claim(s) 1-31, 33-55, 57-72 and 75-79 is/are rejected.
- 7) ☒ Claim(s) 56 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>1/13/10</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-31, 33-79 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 78 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The recitation in claim 78 of “wherein a first heat exchange fluid flows in the first set of heat exchange channels...and another heat exchange fluid flows in the another set of heat exchange channels...the first heat exchange fluid being...different than the another heat exchange fluid” does not appear to have support in the specification. Applicant is requested to point out support for this amendment.

Claim Objections

Claim 79 is objected to because of the following informalities: claim 79 is missing a period. Appropriate correction is required.

Claim Rejections - 35 USC § 103

Art Unit: 1793

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-29, 31, 33-51, 54, 55, 57-59, 62-64, 69-72, 75, 78, 79 are rejected under 35 U.S.C. 103(a) as being unpatentable over TeGrotenhuis et al. (WO 03/078052) in view of Tonkovich (US 7470408 which claims priority to provisional application 60/531,006, which is referred to herein) and Brophy (US 7118920).

TeGrotenhuis teach a process for oxidation (page 27) wherein the reactions are equilibrated to 90% conversion (page 13) and plural fins coated with catalysts (fig. 10, #164), are used in the process (page 26) wherein the multiple microchannels have temperatures around 300°C (page 31). TeGrotenhuis additionally teach or suggest limitations including: another reaction temperature in a second step is lower than the reaction temperature in a first step (page 13), the dimensions of the microchannel (page

Art Unit: 1793

9), counter-current relationship of fluid of microchannel with heat-exchange channel (page 15).

TeGrotenhuis fail to teach that an intermediate is formed in a first reaction zone with a first catalyst and a final product is formed in a second reaction zone and that the reaction zones are separated by a non-reactive zone, the first reaction zone and another reaction zone being in the same process microchannel.

Regarding claims 1, 15, 16, Tonkovich, however, teaches *in situ* mixing in microchannels (page 1) wherein different catalysts can be disposed along a microchannel (that form different reaction stages) with non-reactive zones between the different reaction zones for the purpose of providing a reaction channel that can produce a product in a two-step process via an intermediate product (page 5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time applicant's invention was made to provide different catalysts disposed along a microchannel (that form different reaction stages) with non-reactive zones between the different reaction zones in TeGrotenhuis in order to provide a reaction channel that can produce a product in a two-step process via an intermediate product (page 5) as taught by Tonkovich.

Regarding claims 1, 3, 13, 14; in the alternative, Tonkovich teaches *in situ* mixing in microchannels (page 1) similar catalysts can be disposed along a microchannel (that form different reaction stages) with non-reactive zones between the different reaction zones for the purpose of reducing the amount of side reactions (page 5).

Art Unit: 1793

Therefore, it would have been obvious to one of ordinary skill in the art at the time applicant's invention was made to provide similar catalysts disposed along a microchannel (that form different reaction stages) with non-reactive zones between the different reaction zones in TeGrotenhuis in order to provide a reaction channel that has a reduced amount of side reactions (page 5) as taught by Tonkovich.

TeGrotenhuis fails to teach that the heat exchanger comprises the heat exchange fluid undergoing a phase change in the heat exchange channels.

Brophy, however, teaches a carrying out reactions in microchannels (col. 1, lines 5-10) wherein it is preferable for the heat exchange fluids to have a phase change in the heat exchanger (col. 12, lines 50-62).

Therefore, it would have been obvious to one of ordinary skill in the art at the time applicant's invention was made to provide the heat exchange fluids to have a phase change in the heat exchanger (col. 12, lines 50-62) in TeGrotenhis in order to carry out chemical reactions in microchannels as taught by Brophy.

Regarding claim 2, 4, Tonkovich teaches that the number of catalysts can be extended to any desirable degree (page 5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time applicant's invention was made to provide an additional catalyst in TeGrotenhuis because Tonkovich teaches that the number of catalysts can be determined readily through routine experimentation (page 5).

Regarding claims 5,6, 8,12, TeGrotenhuis teaches that the heat-exchange channel is counter-current (page 15).

Art Unit: 1793

Regarding claim 11, TeGrotenhuis teaches that the heat-exchange channel is co-current (page 15).

Regarding claim 19, TeGrotenhuis teaches materials for the microchannel (page 21).

Regarding claim 20, 23, TeGrotenhuis teaches counter-current relationship of the fluid of microchannel with heat-exchange channel (page 15).

Regarding claim 24, TeGrotenhuis teaches a co-current relationship of the fluid of microchannel with heat-exchange channel (page 15).

Regarding claims 44-47, TeGrotenhuis teaches that the fins are coated with support foam that supports the catalyst coating (page 24).

Regarding claims 27 and 29, one of ordinary skill in the art would recognize that normal error rates in production of the microchannels and heat exchange channels would result in a slight variance of length the channels such that heat exchange channels would have a length that is different than the length the process microchannels.

Regarding claims 48 and 49, one of ordinary skill in the art would recognize that normal error rates in production of the fins would result in a slight variance of length and height of the fins such that at least one of the fins would have a length and/or height that is different than the length and/or height of the other fins.

Additionally, for claims 27,29,48,49, the claims recite certain dimensions being shorter than other dimensions. It appears that any variance would constitute a difference in dimension, i.e. the range would be anything less than exactly the same

Art Unit: 1793

dimension. Because a dimension being slightly shorter than another dimension would be encompassed in this range, the prior art range is so close that one skilled in the art would have expected it to have the same properties. *Titanium Metals Corp. v. Banner*, 227 USPQ 773.

Regarding claim 55, TeGrotenhuis teaches that a method carried out is methanol synthesis. Additionally, it appears that carrying out this process would necessarily require an equilibrium approach substantially overlapping that of the claimed invention (more than 5%). In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05 (I).

Additionally, it appears that Tonkovich is silent with respect to whether there is catalyst in the heat exchanger chamber (fig. 2d, 220). However, catalyst is sometimes added to exothermic chamber (100). One of ordinary skill in the art at the time applicant's invention was made would recognize that there is no catalyst present in the heat exchanger zone of Tonkovich because a catalyst coating is only mentioned regarding the exothermic chamber.

Additionally, it would have been obvious to incorporate these singular elements into an integral reactor. *In re Larson*, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) (A claim to a fluid transporting vehicle was rejected as obvious over a prior art reference which differed from the prior art in claiming a brake drum integral with a clamping means, whereas the brake disc and clamp of the prior art comprise several parts rigidly secured together as a single unit. MPEP 2144.05.

Art Unit: 1793

It appears that a 100% approach to equilibrium would be about 50% conversion as an approach to equilibrium would equate to roughly half of the reactants being consumed. As TeGrotenhuis teaches that the processes have generally a 90% conversion rate, it appears that this would be equivalent to an approach to equilibrium of close to 100% and therefore overlaps with the range in the claims. In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05 (I).

Regarding claim 75, Tonkovich teaches that the flow through the microchannels is in excess of 50 m/s (page 3) and that the volume of the microchannels is 2 milliliters.

It appears that the range of 50 m/s overlaps with a product rate of at least 1 SLPM. In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05 (I).

Regarding the limitation in claim 78 of a first heat exchange fluid in first heat exchange channels and another heat exchange fluid flowing in another set of heat exchange channels wherein the first heat exchange fluid is the same as the another heat exchange fluid, the court held that mere duplication of parts has no patentable significance unless a new and unexpected result is produced. MPEP 2144.04 (VI) (B).

Claims 52 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over TeGrotenhuis et al. (WO 03/078052) in view of Tonkovich (US 7470408 which claims priority to provisional application 60/531,006, which is referred to herein) and Brophy (US 7118920) and Reyes (US 6726850).

Art Unit: 1793

TeGrotenhuis teaches the process as described above in claim 1.

TeGrotenhuis fails to teach the material of the support for the catalyst.

Regarding claims 52 and 53, Reyes teaches that alumina is a well known support for catalysts (col. 5).

Therefore, it would have been obvious to make the ribs of TeGrotenhuis out of alumina in order to provide a well known support for catalysts as taught by Reyes

Claims 60, 61, 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over TeGrotenhuis et al. (WO 03/078052) in view of Tonkovich (US 7470408 which claims priority to provisional application 60/531,006, which is referred to herein) and Brophy (US 7118920) and Ghosh (US 5961932).

TeGrotenhuis teaches a process as described above in claim 1.

TeGrotenhuis fails to teach the claimed contact time.

Ghosh teaches a method of carrying out chemical reactions in microreactors (col. 1, lines 14-31) wherein contact time in a microchannel for two reactants is 1 second for the purpose of allowing near complete mixing of the reactants (col. 1, line 65-col. 2, line 5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time applicant's invention was made to provide the contact time in the microchannel for two reactants is 1 second in TeGrotenhuis in order to allow for near complete mixing of the reactants (col. 1, line 65-col. 2, line 5) as taught by Ghosh.

Regarding claims 60 and 61, one of ordinary skill would recognize that the contact time would be smaller for smaller channels. Therefore, smaller channels such as those taught by TeGrotenhuis (less than 0.5 mm, page 9) will result in contact times smaller than 1 second such that the range of contact times contemplated by the prior art overlaps with those of claims 60 and 61. In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05 (I).

Claims 30, 65-68 and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over TeGrotenhuis et al. (WO 03/078052) in view of Tonkovich (US 7470408 which claims priority to provisional application 60/531,006, which is referred to herein) and Brophy (US 7118920) and Tonkovich (US 7029647).

TeGrotenhuis teaches a method as described above in claim 1.

TeGrotenhuis fails to teach the claimed pressure in the heat exchange fluid.

Tonkovich '647, however, teaches a method for carrying out chemical reactions in microchannels (col. 1) wherein the pressure in the microchannels is from 1-3 atm (col. 18, lines 54-60) and the pressure drop is up to 10 atm/m (col. 19, lines 15-25).

Therefore, it would have been obvious to one of ordinary skill in the art at the time applicant's invention was made to provide pressure in the microchannels is from 1-3 atm (col. 18, lines 54-60) and the pressure drop is up to 10 atm/m (col. 19, lines 15-25) in TeGrotenhuis in order to carry out chemical reactions in microreactors as taught by Tonkovich '647.

Art Unit: 1793

Regarding claim 77, Tonkovich teaches that the flow through the microchannels is in excess of 50 m/s (page 3) and that the volume of the microchannels is 2 milliliters.

It appears that the range of 50 m/s overlaps with a product rate of at least 1 SLPM. In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a prima facie case of obviousness exists. MPEP 2144.05 (I).

Regarding claim 68, Tonkovich ‘647 also teaches that unreacted starting materials are recycled back to the inlet (col. 4, lines 20-35).

Therefore, it would have been obvious to one of ordinary skill in the art at the time applicant’s invention was made to provide unreacted starting materials are recycled back to the inlet (col. 4, lines 20-35) in TeGrotenhuis in order to carry out chemical reactions in microreactors as taught by Tonkovich ‘647.

Regarding claim 30, Tonkovich ‘647 also teaches that the heat exchange channel is made of copper, inter alia (see claim 11).

Therefore, it would have been obvious to one of ordinary skill in the art at the time applicant’s invention was made to provide the heat exchange channel is made of copper, inter alia (see claim 11) in TeGrotenhuis in order to carry out chemical reactions in microreactors as taught by Tonkovich ‘647.

Allowable Subject Matter

Claims 73 and 74 are allowed.

The following is an examiner’s statement of reasons for allowance: the prior art of record does not teach or suggest a process for generating either methanol or dimethyl

Art Unit: 1793

ether in a microreactor wherein the product is formed in a, at least, two step process with the claimed equilibrium conversions.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Claim 56 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: the prior art of record fails to teach or suggest a process for generating dimethyl ether in a microreactor wherein the product is formed in a, at least, two step process.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to PAUL A. WARTALOWICZ whose telephone number is (571)272-5957. The examiner can normally be reached on 8:30-6 M-Th and 8:30-5 on Alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1793

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Paul Wartalowicz
May 8, 2010

/Stanley Silverman/
Supervisory Patent Examiner, AU 1793